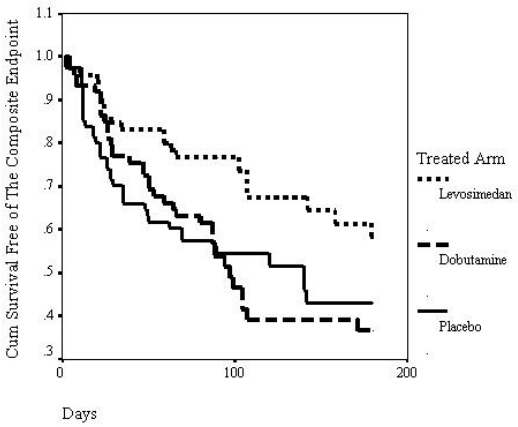


POSTER SESSION

1126 Heart Failure: Diagnostic Methods

Tuesday, March 09, 2004, 9:00 a.m.-11:00 a.m.
Morial Convention Center, Hall G
Presentation Hour: 10:00 a.m.-11:00 a.m.

1126-109 Impedance Cardiography in Heart Failure Patients in the Intensive Care Unit: Its Value in the Detection of Left Ventricular Systolic Dysfunction and Correlation With the Echocardiogram

Marcellus Francis L. Ramirez, Crismelita E. Marinas, Milagros E. Yamamoto, Eduardo Vicente S. Caguioa, University of Santo Tomas, Manila, Philippines

Background: Impedance cardiography (ICG) is a simple noninvasive method capable of determining multiple hemodynamic parameters, which include indices of systolic cardiac function. It has been utilized in the hemodynamic evaluation of patients with congestive heart failure. This study describes and differentiates the ICG findings of heart failure patients with normal and abnormal systolic function, and evaluates the ability of the ICG to detect systolic dysfunction in patients with heart failure, as well as its correlation with the echocardiogram.

Methodology:
Sixty-seven consecutive adult patients with heart failure, and admitted to the intensive care unit were included. Impedance cardiography was done on admission, and a transthoracic echocardiogram was done within 24 hours. The population was grouped into two based on echocardiographic evaluation – (a) normal systolic function with normal ejection fraction, and (b) abnormal systolic function with ejection fraction <50%. ICG parameters of systolic function were then described in the two groups. ICG parameters of systolic function were then compared and correlated with the echocardiographic parameters of systolic function.

Results:
Of the 67 patients, 30 had a low EF(<50%) and 37 had a normal EF as described by echocardiogram. For the group with a low EF, the ICG findings revealed a decreased acceleration index and velocity index. For the second group,ICG showed a normal acceleration index and velocity index. When compared with the standard echocardiogram, the ICG was 70% sensitive and 73% specific in detecting systolic dysfunction. Correlation studies using the acceleration index against the presence of systolic dysfunction showed moderately high correlation at $p<0.01$.

Conclusion:
Impedance cardiography is useful in the noninvasive hemodynamic assessment of heart failure patients. Patients with systolic dysfunction demonstrate a low acceleration index and a low velocity index by ICG, while those with normal systolic function show normal values in both parameters. The ICG correlates moderately with the echocardiogram in the detection of systolic dysfunction.

1126-110 Predicting Significant Coronary Artery Disease in Heart Failure Patients

David J. Whellan, Robert H. Tuttle, Linda K. Shaw, James G. Jollis, Christopher M. O'Connor, Salvador Borges-Neto, Duke Clinical Research Institute, Durham, NC

Background: Current guidelines state that patients with low ejection fraction (EF) should be evaluated for coronary artery disease (CAD). The objective of the current study was to develop a model to assist clinicians in determining the likelihood of CAD prior to cardiac catheterization (cath).

Method: Subjects were identified from the Duke Databank for Cardiovascular Disease. Patients had cath between 1992 and 2000, that was preceded by echocardiography (echo) with an EF $\leq$45%. Patients were considered to have significant CAD if any epicardial vessel had $\geq$75% stenosis. A multivariable model of CAD was generated using stepwise logistic regression.. We included demographic, clinical, and echo parameters, including segmental wall motion abnormality (SWMA, defined as any difference in wall motion between segments).

Results: 2241 patients meeting the criteria were identified. Of these patients, 1225 (57%) had +CAD; 964 (43%) had –CAD. The median age was 63 and the EF was 30%. SWMA was identified as a significant predictor of CAD (Table 1, listed in order of contribution to the model). The area under the ROC curve was 0.852.

Conclusion: By utilizing baseline demographic and clinical characteristics as well as echo-derived SWMA, we developed highly discriminatory diagnostic model for predicting CAD in heart failure patients. Given the high prevalence of –CAD (43% in this cohort), accurate baseline assessment of patients with LV dysfunction for CAD might avoid a significant amount of unnecessary testing.

Predictors of CAD in HF Patients

Parameter	Odds Ratio (95% CI)	P-value
History of MI	5.9 (4.5;7.6)	<.0001
Age (every 10 yrs.)	1.6 (1.5;1.8)	<.0001
Diabetes	2.3 (1.8;2.9)	<.0001
Male	2.1 (1.7;2.7)	<.0001
SWMA	2.1 (1.6;2.7)	<.0001

1126-111 A Normal Left Atrial Size Has a Very High Negative Predictive Value in Excluding Abnormal Left Ventricular Systolic Function

Mohammad Reza Movahed, Babak Kasravi, Ronald Gim, Mastaneh Ahmadi-Kashani, University of California, Irvine Medical Center, Orange, CA

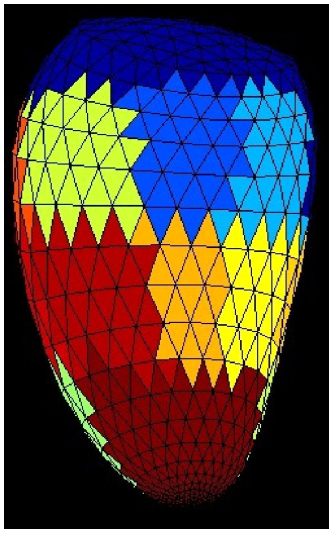
Introduction: It is well known that decreased left ventricular (LV) systolic function is associated with left atrial (LA) enlargement. However it is unknown if decreased LV systolic function can be excluded in the presence of a normal LA size. The goal of this study was to evaluate the negative predictive value of a normal LA size with respect to decreased LV systolic function in a large cohort undergoing diagnostic echocardiography.
Methods: We retrospectively analyzed 21,786 echocardiograms with documented LA size performed at our institution from 1984 to 1998. We analyzed the data based on the normal value for LA size defined as 40 mm or less measured by M-mode and two-dimensional echocardiography in parasternal long axis. The prevalence of normal LA size as well as its negative predictive value was calculated. **Results:** Normal LA size was present in 12,583 (57.8%) patients. In this cohort, only 304 (2.4%) had abnormal LV systolic function. Negative predictive value of a normal LA size with regards to abnormal LV systolic function was calculated to be 98%. The negative predictive value increases to 99% if using LA size of 35 mm or less as the upper limit. **Conclusion:** A simple measurement of LA size using M-mode and two-dimensional echocardiography in parasternal axis is highly valuable in assessment of LV systolic function. A normal LA size has a very high negative predictive value of 98% in excluding abnormal LV systolic function.

1126-112 The CenterSurface Method for Quantatative Evaluation of Cardiac Magnetic Resonance Regional Wall Thickening

Nirat Beohar, Adam Brodsky, Charles J. Davidson, Daniel Lee, Edwin Wu, Edward Bolson, Robert O. Bonow, Florence Sheehan, Feinberg School of Medicine of Northwestern University, Chicago, IL, University of Washington, Seattle, WA

Background: The Centerline Method has been used for regional wall motion analysis of the LV. Whether these methods can be applied to quantify 3-D LV wall thickening of cardiac MR is unknown.
Methods: A computer algorithm based CenterSurface method was used to compare fractional thickening between MI induced percutaneously (n=19) by 90-minute proximal LCX balloon occlusion and control (n=3) in a pig model. CineMR was performed 8 weeks post MI. Regional wall thickening was measured orthogonal to the CenterSurface, a triangulated surface constructed midway between the endo- and epicardium (Figure 1). For segmental analysis, a long axis was constructed from mid-point of mitral annulus to apex. Sixteen segments were created: 6 basal and 6 medial 60 degree segments, and 4 apical 90 degree segments. Mean segmental thickening=End systolic mean thickness – End diastolic mean thickness/End diastolic mean thickness. Weighted average, based on number of vertices per segment was calculated for infarct and noninfarct areas.
Results: Mean thickening in LCX area was 0.45±0.1 for control and 0.22±0.1 for MI; p=0.004. Mean thickening in non LCX area was 0.3±0.09 for control and 0.2±0.2 for MI; p=0.5. LVEF was 52% for control, 41% for MI; p=0.04.
Conclusions: The CenterSurface method can be used to quantify left ventricular function of cardiac MR images. This technique can be used to evaluate regional wall thickening after myocardial infarction.
Figure 1. 3D CenterSurface rotated to

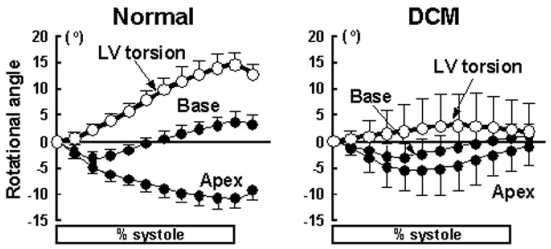
show Inferior/Lateral target plot



1126-113 Impaired Left Ventricular Systolic Torsion in Dilated Cardiomyopathy Characterized With Magnetic Resonance Tagging Method

Hideaki Kanzaki, Satoshi Nakatani, Naoaki Yamada, Shin-ichi Urayama, Kunio Miyatake, National Cardiovascular Center, Osaka, Japan, University of Pittsburgh, Pittsburgh, PA

Background: Left ventricular (LV) torsion is a crucial component for effective LV squeezing. However, the time course of torsion dynamics in dilated cardiomyopathy (DCM) remains unclear. Our objective was to characterize systolic torsion in DCM using myocardial magnetic resonance (MR) tagging method.
Methods: Twenty-six subjects were studied: 17 patients with DCM (ejection fraction [EF] 27 ± 9%) and 9 controls. MR tagged images were acquired at three levels (base, mid, and apex). Intersecting tag points on myocardium were tracked during systole, thereby determining serial angular displacements of each level relative to the short axis centroid (positive degrees indicated a clockwise rotation as viewed from the apex). LV torsion was defined as net angular difference between the basal and apical levels. Time to peak LV torsion was expressed with % systole obtained by dividing the time from end-diastole by a total systolic time.
Results: Peak rotational angle in DCM was impaired at both levels of the base (0.2 ± 3.3 vs. 2.7 ± 2.0 degrees, $p < 0.05$ vs. control) and apex (-5.0 ± 5.0 vs. -10.1 ± 3.3 degrees, $p < 0.01$ vs. control). LV torsion then peaked earlier and less in DCM than in controls (66 ± 22 vs. 104 ± 16% systole; 5.8 ± 3.6 vs. 13.7 ± 2.7 degrees, both $p < 0.001$), and correlated with LVEF ($r = 0.78$, $p < 0.01$).
Conclusion: In DCM, peak LV systolic torsion was also impaired, being proportional to global LV function. This is likely due to insufficient wringing behavior from the apical and basal opposing rotations.



1126-114 Clinical and Magnetic Resonance Imaging Characteristics of Pathologically Confirmed Left Ventricular Thrombus in Patients With Cardiomyopathy

Chelif Junor, Monvadi Barbara Srichai, Luis Rodriguez, Arthur E. Stillman, Richard D. White, Richard A. Grimm, Cleveland Clinic Foundation, Cleveland, OH

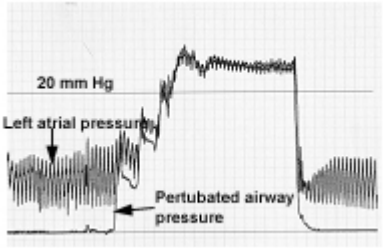
Background: Development of left ventricular (LV) thrombus is a serious complication for patients with structural and functional heart disease. Determination of clinical and imaging characteristics of patients with heart disease who develop LV thrombi may provide important prognostic and therapeutic information. We sought to identify clinical and imaging parameters which may correlate with development of LV thrombus in patients with heart disease.
Method: Patients who underwent LV reconstruction with direct visualization of the LV cavity or had pathologic evidence of presence or absence of LV thrombus (autopsy or explanted heart) were included. Demographics and clinical history were obtained from the patient's electronic medical record. Preoperative cardiac magnetic resonance imaging studies were reviewed for LV size, function, and development of LV aneurysm.
Results: Population consisted of 135 patients (mean age 62.2; male 76 %) with heart disease (131 with ischemic heart disease and 4 with dilated cardiomyopathy). 47 (35%) had thrombus detected at surgery or by pathology. See table below for a summary of the clinical and imaging data. 2 patients had acute embolic events in the thrombus group. Also of note, coumadin and aspirin use was not different between groups.
Conclusion: Pathologically proven LV thrombus was found in approximately one third of the patients. Patients with LV thrombus had lower LV function while demonstrating a trend toward greater LV volumes and aneurysm development.

Clinical or Image characteristic	No Thrombus (n=88)	Thrombus (n=47)	P value
Female sex	24%	26%	NS
Age	59.7 +/- 9.4	62.4 +/- 8.5	NS
Aneurysm presence	65%	68%	NS
End diastolic volume	287 +/- 71	311 +/- 111	NS
End systolic volume	218 +/- 68	260 +/- 99	<0.05
Ejection fraction	26.8 +/- 8.6 %	22.7 +/- 6.7%	<0.01
Coumadin use	28%	29%	NS
Aspirin use	64%	59%	NS
History of stroke or peripheral embolic event	10%	9%	NS
Atrial fibrillation	11%	9%	NS
Hypertension	61%	56%	NS
Diabetes Mellitus	28%	31%	NS
Hyperlipidemia	69%	60%	NS
Tobacco use history	46%	64%	NS

1126-115 Chronic Implantation of Left Atrial Pressure Monitor Accurately Measures Left Atrial Pressure in Porcine Model

Saibal Kar, Joseph Aragon, Dougal McClean, Aamer Jamali, James Whiting, Frank Litvack, Neal Eigler, Cedars Sinai Medical Center, Los Angeles, CA

Background and Purpose: Left atrial pressure (LAP) monitoring can guide therapy of heart failure. We evaluated performance, calibration, and healing of implanted Heart(POD) systems in vivo.
Methods. Anesthetized pigs (n=5) were implanted with PODs comprised of a sensor lead that measures LAP, temperature and intracardiac electrogram IEGM. POD is remotely powered and telemetry read by a modified palm computer. PODs were inserted by transseptal cath from the right jugular vein. Repeat cath and pseudo Valsalva (closed airway + abdominal pressure) (N=10) were performed followed by euthanasia at 0, 14, 21, 125, and 180 (pending) days.
Results. All PODs were successfully implanted. Twice a week ambulatory monitoring detected high fidelity LAP and IEGM waveforms for the duration survival. At 125 days LAP offset had drifted <2 mmHg and gain was attenuated -0.51%. The LA and RA surfaces were covered with nonthrombotic neointima at 21 days and fully healed at 125 days. Valsalva (Fig) calibrated pressure with an error of -0.4±0.9 mmHg.
Conclusions. These studies establish early 'proof-of-concept' for POD implantation in large animals. Chronic LAP monitoring is feasible, and remains accurate despite sensor overgrowth by tissue. An accurate non-invasive means of recalibration was validated.



1126-116 The Utility of High Frequency QRS Electrocardiogram in the Diagnosis of Cardiomyopathy

Reynolds M. Delgado, III, Gregory V. Poulin, Bojan Vrtovec, Cathy Eastwood, Branislav Radovancevic, Wayne Franklin, Biswajit Kar, Todd T. Schlegel, St. Luke's Episcopal Hospital/Texas Heart Institute, Houston, TX, National Aeronautics and Space Administration (NASA), Houston, TX

Background. High frequency (HF) QRS ECG (150-250 Hz) over entire QRS interval is known to be more sensitive than standard conventional ECG for detecting myocardial ischemia. However, the use of HF QRS ECG in patients with left ventricular mechanical dysfunction has been less extensively studied. *Methods.* We obtained 12-lead HF QRS ECGs in 29 patients with cardiomyopathy (EF < 40% by echocardiography, mean ± SD 23.1 ± 6.6%) and in 29 age- and gender-matched healthy controls using PC-based ECG